1652

Attorney Docket No.: 13761-726

#9

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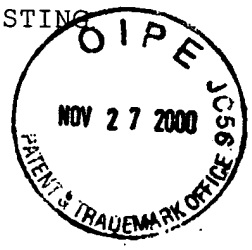

<110> University of Southern California
Stallcup, Michael R.
Chen, Dagang
Hong, Heng
Asward, Dana W.

<120> REGULATION OF GENE EXPRESSION BY PROTEIN METHYLATION

<130> 13761-726

<140> US 09/464,377
<141> 1999-12-15

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<210> 2
<211> 608
<212> PRT
<213> Artificial Sequence

<220>
<223> Deduced amino acid sequence of CARM1

<400> 2

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Gly Val Ala Gly Pro Gly Gly Ala Gly Pro Cys Ala Thr Val Ser Val
            20                  25                  30
Phe Pro Gly Ala Arg Leu Leu Thr Ile Gly Asp Ala Asn Gly Glu Ile
        35                  40                  45
Gln Arg His Ala Glu Gln Gln Ala Leu Arg Leu Glu Val Arg Ala Gly
```

```
    50                  55                  60
Pro Asp Ala Ala Gly Ile Ala Leu Tyr Ser His Glu Asp Val Cys Val
65                  70                  75                  80
Phe Lys Cys Ser Val Ser Arg Glu Thr Glu Cys Ser Arg Val Gly Arg
                85                  90                  95
Gln Ser Phe Ile Ile Thr Leu Gly Cys Asn Ser Val Leu Ile Gln Phe
            100                 105                 110
Ala Thr Pro His Asp Phe Cys Ser Phe Tyr Asn Ile Leu Lys Thr Cys
        115                 120                 125
Arg Gly His Thr Leu Glu Arg Ser Val Phe Ser Glu Arg Thr Glu Glu
    130                 135                 140
Ser Ser Ala Val Gln Tyr Phe Gln Phe Tyr Gly Tyr Leu Ser Gln Gln
145                 150                 155                 160
Gln Asn Met Met Gln Asp Tyr Val Arg Thr Gly Thr Tyr Gln Arg Ala
                165                 170                 175
Ile Leu Gln Asn His Thr Asp Phe Lys Asp Lys Ile Val Leu Asp Val
            180                 185                 190
Gly Cys Gly Ser Gly Ile Leu Ser Phe Phe Ala Ala Gln Ala Gly Ala
        195                 200                 205
Arg Lys Ile Tyr Ala Val Glu Ala Ser Thr Met Ala Gln His Ala Glu
    210                 215                 220
Val Leu Val Lys Ser Asn Asn Leu Thr Asp Arg Ile Val Val Ile Pro
225                 230                 235                 240
Gly Lys Val Glu Glu Val Ser Leu Pro Glu Gln Val Asp Ile Ile Ile
                245                 250                 255
Ser Glu Pro Met Gly Tyr Met Leu Phe Asn Glu Arg Met Leu Glu Ser
            260                 265                 270
Tyr Leu His Ala Lys Lys Tyr Leu Lys Pro Ser Gly Asn Met Phe Pro
        275                 280                 285
Thr Ile Gly Asp Val His Leu Ala Pro Phe Thr Asp Glu Gln Leu Tyr
    290                 295                 300
Met Glu Gln Phe Thr Lys Ala Asn Phe Arg Tyr Gln Pro Ser Phe His
305                 310                 315                 320
Gly Val Asp Leu Ser Ala Leu Arg Gly Ala Ala Val Asp Glu Tyr Phe
                325                 330                 335
Arg Gln Pro Val Val Asp Thr Phe Asp Ile Arg Ile Leu Met Ala Lys
            340                 345                 350
Ser Val Lys Tyr Thr Val Asn Phe Leu Glu Ala Lys Glu Gly Asp Leu
        355                 360                 365
His Arg Ile Glu Ile Pro Phe Lys Phe His Met Leu His Ser Gly Leu
    370                 375                 380
Val His Gly Leu Ala Phe Trp Phe Asp Val Ala Phe Ile Gly Ser Ile
385                 390                 395                 400
Met Thr Val Trp Leu Ser Thr Ala Pro Thr Glu Pro Leu Thr His Trp
                405                 410                 415
Tyr Gln Val Arg Cys Leu Phe Gln Ser Pro Leu Phe Ala Lys Ala Gly
            420                 425                 430
Asp Thr Leu Ser Gly Thr Cys Leu Leu Ile Ala Asn Lys Arg Gln Ser
        435                 440                 445
Tyr Asp Ile Ser Ile Val Ala Gln Val Asp Gln Thr Gly Ser Lys Ser
```

```
    450                 455                 460
Ser Asn Leu Leu Asp Leu Lys Asn Pro Phe Phe Arg Tyr Thr Gly Thr
465                 470                 475                 480
Thr Pro Ser Pro Pro Pro Gly Ser His Tyr Thr Ser Pro Ser Glu Asn
                485                 490                 495
Met Trp Asn Thr Gly Ser Thr Tyr Asn Leu Ser Ser Gly Val Ala Val
            500                 505                 510
Ala Gly Met Pro Thr Ala Tyr Asp Leu Ser Ser Val Ile Ala Gly Gly
        515                 520                 525
Ser Ser Val Gly His Asn Asn Leu Ile Pro Leu Ala Asn Thr Gly Ile
    530                 535                 540
Val Asn His Thr His Ser Arg Met Gly Ser Ile Met Ser Thr Gly Ile
545                 550                 555                 560
Val Gln Gly Ser Ser Gly Ala Gln Gly Gly Gly Gly Ser Ser Ser Ala
                565                 570                 575
His Tyr Ala Val Asn Asn Gln Phe Thr Met Gly Gly Pro Ala Ile Ser
            580                 585                 590
Met Ala Ser Pro Met Ser Ile Pro Thr Asn Thr Met His Tyr Gly Ser
        595                 600                 605
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<210> 3
<211> 608
<212> PRT
<213> Artificial Sequence

<220>
<223> CARM1 VLD TO AAA Variant

<400> 3

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Met Ala Ala Ala Ala Ala Thr Ala Val Gly Pro Gly Ala Gly Ser Ala
 1                5                  10                  15
Gly Val Ala Gly Pro Gly Gly Ala Gly Pro Cys Ala Thr Val Ser Val
            20                  25                  30
Phe Pro Gly Ala Arg Leu Leu Thr Ile Gly Asp Ala Asn Gly Glu Ile
        35                  40                  45
Gln Arg His Ala Glu Gln Gln Ala Leu Arg Leu Glu Val Arg Ala Gly
    50                  55                  60
Pro Asp Ala Ala Gly Ile Ala Leu Tyr Ser His Glu Asp Val Cys Val
65                  70                  75                  80
Phe Lys Cys Ser Val Ser Arg Glu Thr Glu Cys Ser Arg Val Gly Arg
                85                  90                  95
Gln Ser Phe Ile Ile Thr Leu Gly Cys Asn Ser Val Leu Ile Gln Phe
            100                 105                 110
Ala Thr Pro His Asp Phe Cys Ser Phe Tyr Asn Ile Leu Lys Thr Cys
        115                 120                 125
Arg Gly His Thr Leu Glu Arg Ser Val Phe Ser Glu Arg Thr Glu Glu
    130                 135                 140
Ser Ser Ala Val Gln Tyr Phe Gln Phe Tyr Gly Tyr Leu Ser Gln Gln
145                 150                 155                 160
Gln Asn Met Met Gln Asp Tyr Val Arg Thr Gly Thr Tyr Gln Arg Ala
```

```
                165                 170                 175
Ile Leu Gln Asn His Thr Asp Phe Lys Asp Lys Ile Ala Ala Ala Val
            180                 185                 190
Gly Cys Gly Ser Gly Ile Leu Ser Phe Phe Ala Ala Gln Ala Gly Ala
        195                 200                 205
Arg Lys Ile Tyr Ala Val Glu Ala Ser Thr Met Ala Gln His Ala Glu
    210                 215                 220
Val Leu Val Lys Ser Asn Asn Leu Thr Asp Arg Ile Val Val Ile Pro
225                 230                 235                 240
Gly Lys Val Glu Glu Val Ser Leu Pro Glu Gln Val Asp Ile Ile Ile
                245                 250                 255
Ser Glu Pro Met Gly Tyr Met Leu Phe Asn Glu Arg Met Leu Glu Ser
            260                 265                 270
Tyr Leu His Ala Lys Lys Tyr Leu Lys Pro Ser Gly Asn Met Phe Pro
        275                 280                 285
Thr Ile Gly Asp Val His Leu Ala Pro Phe Thr Asp Glu Gln Leu Tyr
    290                 295                 300
Met Glu Gln Phe Thr Lys Ala Asn Phe Arg Tyr Gln Pro Ser Phe His
305                 310                 315                 320
Gly Val Asp Leu Ser Ala Leu Arg Gly Ala Ala Val Asp Glu Tyr Phe
                325                 330                 335
Arg Gln Pro Val Val Asp Thr Phe Asp Ile Arg Ile Leu Met Ala Lys
            340                 345                 350
Ser Val Lys Tyr Thr Val Asn Phe Leu Glu Ala Lys Glu Gly Asp Leu
        355                 360                 365
His Arg Ile Glu Ile Pro Phe Lys Phe His Met Leu His Ser Gly Leu
    370                 375                 380
Val His Gly Leu Ala Phe Trp Phe Asp Val Ala Phe Ile Gly Ser Ile
385                 390                 395                 400
Met Thr Val Trp Leu Ser Thr Ala Pro Thr Glu Pro Leu Thr His Trp
                405                 410                 415
Tyr Gln Val Arg Cys Leu Phe Gln Ser Pro Leu Phe Ala Lys Ala Gly
            420                 425                 430
Asp Thr Leu Ser Gly Thr Cys Leu Leu Ile Ala Asn Lys Arg Gln Ser
        435                 440                 445
Tyr Asp Ile Ser Ile Val Ala Gln Val Asp Gln Thr Gly Ser Lys Ser
    450                 455                 460
Ser Asn Leu Leu Asp Leu Lys Asn Pro Phe Phe Arg Tyr Thr Gly Thr
465                 470                 475                 480
Thr Pro Ser Pro Pro Pro Gly Ser His Tyr Thr Ser Pro Ser Glu Asn
                485                 490                 495
Met Trp Asn Thr Gly Ser Thr Tyr Asn Leu Ser Ser Gly Val Ala Val
            500                 505                 510
Ala Gly Met Pro Thr Ala Tyr Asp Leu Ser Ser Val Ile Ala Gly Gly
        515                 520                 525
Ser Ser Val Gly His Asn Asn Leu Ile Pro Leu Ala Asn Thr Gly Ile
    530                 535                 540
Val Asn His Thr His Ser Arg Met Gly Ser Ile Met Ser Thr Gly Ile
545                 550                 555                 560
Val Gln Gly Ser Ser Gly Ala Gln Gly Gly Gly Gly Ser Ser Ser Ala
```

```
                565                 570                 575
His Tyr Ala Val Asn Asn Gln Phe Thr Met Gly Gly Pro Ala Ile Ser
            580                 585                 590
Met Ala Ser Pro Met Ser Ile Pro Thr Asn Thr Met His Tyr Gly Ser
        595                 600                 605
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<210> 4
<211> 10
<212> PRT
<213> Artifical Sequence

<220>
<223> Peptide used for in vitro methylation experiments

<400> 4
Gly Gly Phe Gly Gly Arg Gly Gly Phe Gly
 1   5   10

<210> 5
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Peptide used for in vitro methylation experiments

<400> 5
Gly Gly Phe Gly Gly Lys Gly Gly Phe Gly
 1   5   10

<210> 6
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> Peptide used to generate anti-CARM1 antisera

<400> 6
Cys Ser Pro Met Ser Ile Pro Thr Asn Thr Met His Tyr Gly Ser
 1   5   10   15

<210> 7
<211> 343
<212> PRT
<213> Artifical Sequence

<220>
<223> Human PRMT1

<400> 7

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 1               5                  10                  15
Glu Asp Met Thr Ser Lys Asp Tyr Tyr Phe Asp Ser Tyr Ala His Phe
            20                  25                  30
Gly Ile His Glu Glu Met Leu Lys Asp Glu Val Arg Thr Leu Thr Tyr
        35                  40                  45
Arg Asn Ser Met Phe His Asn Arg His Leu Phe Lys Asp Lys Val Val
    50                  55                  60
Leu Asp Val Gly Ser Gly Thr Gly Ile Leu Cys Met Phe Ala Ala Lys
65                  70                  75                  80
Ala Gly Ala Arg Lys Val Ile Gly Ile Val Cys Ser Ser Ile Ser Asp
                85                  90                  95
Tyr Ala Val Lys Ile Val Lys Ala Asn Lys Leu Asp His Val Val Thr
            100                 105                 110
Ile Ile Lys Gly Lys Val Glu Glu Val Glu Leu Pro Val Glu Lys Val
        115                 120                 125
Asp Ile Ile Ile Ser Glu Trp Met Gly Tyr Cys Leu Phe Tyr Glu Ser
    130                 135                 140
Met Leu Asn Thr Val Leu Tyr Ala Arg Asp Lys Trp Leu Ala Pro Asp
145                 150                 155                 160
Gly Leu Ile Phe Pro Asp Arg Ala Thr Leu Tyr Val Thr Ala Ile Glu
                165                 170                 175
Asp Arg Gln Tyr Lys Asp Tyr Lys Ile His Trp Trp Glu Asn Val Tyr
            180                 185                 190
Gly Phe Asp Met Ser Cys Ile Lys Asp Val Ala Ile Lys Glu Pro Leu
        195                 200                 205
Val Asp Val Val Asp Pro Lys Gln Leu Val Thr Asn Ala Cys Leu Ile
    210                 215                 220
Lys Glu Val Asp Ile Tyr Thr Val Lys Val Glu Asp Leu Thr Phe Thr
225                 230                 235                 240
Ser Pro Phe Cys Leu Gln Val Lys Arg Asn Asp Tyr Val His Ala Leu
                245                 250                 255
Val Ala Tyr Phe Asn Ile Glu Phe Thr Arg Cys His Lys Arg Thr Gly
            260                 265                 270
Phe Ser Thr Ser Pro Glu Ser Pro Tyr Thr His Trp Lys Gln Thr Val
        275                 280                 285
Phe Tyr Met Glu Asp Tyr Leu Thr Val Lys Thr Gly Glu Glu Ile Phe
    290                 295                 300
Gly Thr Ile Gly Met Arg Pro Asn Ala Lys Asn Asn Arg Asp Leu Asp
305                 310                 315                 320
Phe Thr Ile Asp Leu Asp Phe Lys Gly Gln Leu Cys Glu Leu Ser Cys
                325                 330                 335
Ser Thr Asp Tyr Arg Met Arg
            340
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<210> 8
<211> 433
<212> PRT
<213> Artificial Sequence

<220>
<223> Human PRMT2

<400> 8

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            20                  25                  30
Glu Glu Phe Val Ala Ile Ala Asp Tyr Ala Ala Thr Asp Glu Thr Gln
        35                  40                  45
Leu Ser Phe Leu Arg Gly Glu Lys Ile Leu Ile Leu Arg Gln Thr Thr
    50                  55                  60
Ala Asp Trp Trp Trp Gly Glu Arg Ala Gly Cys Cys Gly Tyr Ile Pro
65                  70                  75                  80
Ala Asn His Val Gly Lys His Val Asp Glu Tyr Asp Pro Glu Asp Thr
                85                  90                  95
Trp Gln Asp Glu Glu Tyr Phe Gly Ser Tyr Gly Thr Leu Lys Leu His
            100                 105                 110
Leu Glu Met Leu Ala Asp Gln Pro Arg Thr Thr Lys Tyr His Ser Val
        115                 120                 125
Ile Leu Gln Asn Lys Glu Ser Leu Thr Asp Lys Val Ile Leu Asp Val
    130                 135                 140
Gly Cys Gly Thr Gly Ile Ile Ser Leu Phe Cys Ala His Tyr Ala Arg
145                 150                 155                 160
Pro Arg Ala Val Tyr Ala Val Glu Ala Ser Glu Met Ala Gln His Thr
                165                 170                 175
Gly Gln Leu Val Leu Gln Asn Gly Phe Ala Asp Ile Ile Thr Val Tyr
            180                 185                 190
Gln Gln Lys Val Glu Asp Val Val Leu Pro Glu Lys Val Asp Val Leu
        195                 200                 205
Val Ser Glu Trp Met Gly Thr Cys Leu Leu Phe Glu Phe Met Ile Glu
    210                 215                 220
Ser Ile Leu Tyr Ala Arg Asp Ala Trp Leu Lys Glu Asp Gly Val Ile
225                 230                 235                 240
Trp Pro Thr Met Ala Ala Leu His Leu Val Pro Cys Ser Ala Asp Lys
                245                 250                 255
Asp Tyr Arg Ser Lys Val Leu Phe Trp Asp Asn Ala Tyr Glu Phe Asn
            260                 265                 270
Leu Ser Ala Leu Lys Ser Leu Ala Val Lys Glu Phe Phe Ser Lys Pro
        275                 280                 285
Lys Tyr Asn His Ile Leu Lys Pro Glu Asp Cys Leu Ser Glu Pro Cys
    290                 295                 300
Thr Ile Leu Gln Leu Asp Met Arg Thr Val Gln Ile Ser Asp Leu Glu
305                 310                 315                 320
Thr Leu Arg Gly Glu Leu Arg Phe Asp Ile Arg Lys Ala Gly Thr Leu
                325                 330                 335
His Gly Phe Thr Ala Trp Phe Ser Val His Phe Gln Ser Leu Gln Glu
            340                 345                 350
Gly Gln Pro Pro Gln Val Leu Ser Thr Gly Pro Phe His Pro Thr Thr
```

```
        355                 360                 365
His Trp Lys Gln Thr Leu Phe Met Met Asp Asp Pro Val Pro Val His
    370                 375                 380
Thr Gly Asp Val Val Thr Gly Ser Val Val Leu Gln Arg Asn Pro Val
385                 390                 395                 400
Trp Arg Arg His Met Ser Val Ala Leu Ser Trp Ala Val Thr Ser Arg
                405                 410                 415
Gln Asp Pro Thr Ser Gln Lys Val Gly Glu Lys Val Phe Pro Ile Trp
            420                 425                 430
Arg
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<210> 9
<211> 512
<212> PRT
<213> Artificial Sequence

<220>
<223> Human PRMT3

<400> 9

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 1               5                  10                  15
Glu Asp Asp Ala Asp Leu Pro His Gly Lys Gln Gln Thr Pro Cys Leu
            20                  25                  30
Phe Cys Asn Arg Leu Phe Thr Ser Ala Glu Glu Thr Phe Ser His Cys
        35                  40                  45
Lys Ser Glu His Gln Phe Asn Ile Asp Ser Met Val His Lys His Gly
    50                  55                  60
Leu Glu Phe Tyr Gly Tyr Ile Lys Leu Ile Asn Phe Ile Arg Leu Lys
65                  70                  75                  80
Asn Pro Thr Val Glu Tyr Met Asn Ser Ile Tyr Asn Pro Val Pro Trp
                85                  90                  95
Glu Lys Glu Glu Tyr Leu Lys Pro Val Leu Glu Asp Asp Leu Leu Leu
            100                 105                 110
Gln Phe Asp Val Glu Asp Leu Tyr Glu Pro Val Ser Val Pro Phe Ser
        115                 120                 125
Tyr Pro Asn Gly Leu Ser Glu Asn Thr Ser Val Val Glu Lys Leu Lys
    130                 135                 140
His Met Glu Ala Arg Ala Leu Ser Ala Glu Ala Ala Leu Ala Arg Ala
145                 150                 155                 160
Arg Glu Asp Leu Gln Lys Met Lys Gln Phe Ala Gln Asp Phe Val Met
                165                 170                 175
His Thr Asp Val Arg Thr Cys Ser Ser Ser Thr Ser Val Ile Ala Asp
            180                 185                 190
Leu Gln Glu Asp Glu Asp Gly Val Tyr Phe Ser Ser Tyr Gly His Tyr
        195                 200                 205
Gly Ile His Glu Glu Met Leu Lys Asp Lys Ile Arg Thr Glu Ser Tyr
    210                 215                 220
Arg Asp Phe Ile Tyr Gln Asn Pro His Ile Phe Lys Asp Lys Val Val
```

225 230 235 240
Leu Asp Val Gly Cys Gly Thr Gly Ile Leu Ser Met Phe Ala Ala Lys
245 250 255
Ala Gly Ala Lys Lys Val Leu Gly Val Asp Gln Ser Glu Ile Leu Tyr
260 265 270
Gln Ala Met Asp Ile Ile Arg Leu Asn Lys Leu Glu Asp Thr Ile Thr
275 280 285
Leu Ile Lys Gly Lys Ile Glu Glu Val His Leu Pro Val Glu Lys Val
290 295 300
Asp Val Ile Ile Ser Glu Trp Met Gly Tyr Phe Leu Leu Phe Glu Ser
305 310 315 320
Met Leu Asp Ser Val Leu Tyr Ala Lys Asn Lys Tyr Leu Ala Lys Gly
325 330 335
Gly Ser Val Tyr Pro Asp Ile Cys Thr Ile Ser Leu Val Ala Val Ser
340 345 350
Asp Val Asn Lys His Ala Asp Arg Ile Ala Phe Trp Asp Asp Val Tyr
355 360 365
Gly Phe Lys Met Ser Cys Met Lys Lys Ala Val Ile Pro Glu Ala Val
370 375 380
Val Glu Val Leu Asp Pro Lys Thr Leu Ile Ser Glu Pro Cys Gly Ile
385 390 395 400
Lys His Ile Asp Cys His Thr Thr Ser Ile Ser Asp Leu Glu Phe Ser
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Ser Asp Phe Thr Leu Lys Ile Thr Arg Thr Ser Met Cys Thr Ala Ile
420 425 430
Ala Gly Tyr Phe Asp Ile Tyr Phe Glu Lys Asn Cys His Asn Arg Val
435 440 445
Val Phe Ser Thr Gly Pro Gln Ser Thr Lys Thr His Trp Lys Gln Thr
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Val Phe Leu Leu Glu Lys Pro Phe Ser Val Lys Ala Gly Glu Ala Leu
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<210> 10
<211> 348
<212> PRT
<213> Artificial Sequence

<220>
<223> Yeast ODP1 Protein Arginine Methyltransferase

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20 25 30
His Glu Glu Met Leu Gln Asp Thr Val Arg Thr Leu Ser Tyr Arg Asn

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        35                  40                  45
Ala Ile Ile Gln Asn Lys Asp Leu Phe Lys Asp Lys Ile Val Leu Asp
    50                  55                  60
Val Gly Cys Gly Thr Gly Ile Leu Ser Met Phe Ala Ala Lys His Gly
65                  70                  75                  80
Ala Lys His Val Ile Gly Val Asp Met Ser Ser Ile Ile Glu Met Ala
                85                  90                  95
Lys Glu Leu Val Glu Leu Asn Gly Phe Ser Asp Lys Ile Thr Leu Leu
            100                 105                 110
Arg Gly Lys Leu Glu Asp Val His Leu Pro Phe Pro Lys Val Asp Ile
        115                 120                 125
Ile Ile Ser Glu Trp Met Gly Tyr Phe Leu Leu Tyr Glu Ser Met Met
    130                 135                 140
Asp Thr Val Leu Tyr Ala Arg Asp His Tyr Leu Val Glu Gly Gly Leu
145                 150                 155                 160
Ile Phe Pro Asp Lys Cys Ser Ile His Leu Ala Gly Leu Glu Asp Ser
                165                 170                 175
Gln Tyr Lys Asp Glu Lys Leu Asn Tyr Trp Gln Asp Val Tyr Gly Phe
            180                 185                 190
Asp Tyr Ser Pro Phe Val Pro Leu Val Leu His Glu Pro Ile Val Asp
        195                 200                 205
Thr Val Glu Arg Asn Asn Val Asn Thr Thr Ser Asp Lys Leu Ile Glu
    210                 215                 220
Phe Asp Leu Asn Thr Val Lys Ile Ser Asp Leu Ala Phe Lys Ser Asn
225                 230                 235                 240
Phe Lys Leu Thr Ala Lys Arg Gln Asp Met Ile Asn Gly Ile Val Thr
                245                 250                 255
Trp Phe Asp Ile Val Phe Pro Ala Pro Lys Gly Lys Arg Pro Val Glu
            260                 265                 270
Phe Ser Thr Gly Pro His Ala Pro Tyr Thr His Trp Lys Gln Thr Ile
        275                 280                 285
Phe Tyr Phe Pro Asp Asp Leu Asp Ala Glu Thr Gly Asp Thr Ile Glu
    290                 295                 300
Gly Glu Leu Val Cys Ser Pro Asn Glu Lys Asn Asn Arg Asp Leu Asn
305                 310                 315                 320
Ile Lys Ile Ser Tyr Lys Phe Glu Ser Asn Gly Ile Asp Gly Asn Ser
                325                 330                 335
Arg Ser Arg Lys Asn Glu Gly Ser Tyr Leu Met His
            340                 345
```